2022 6th International Conference on Building Materials and Materials Engineering
ICBMM 2022

Finishing coatings with reflective nanomaterials: a path to energy-efficient buildings

Rita Carvalho Veloso[1,2*], Catarina Dias[1], Andrea Souza[2], Joana Maia[2], Nuno M.M. Ramos[2], João Ventura[1]

[1]IFIMUP, Departamento de Física e Astronomia, Faculdade de Ciências da Universidade do Porto, Porto, Portugal *up201001431@edu.up.pt

[2]CONSTRUCT-LFC, Departamento de Engenharia Civil, Faculdade de Engenharia da Universidade do Porto, Porto, Portugal

Abstract

The growing concern about energy issues in buildings, namely related to cooling needs, has led to the search for new constructive solutions. Thus, there is a continuous increase in the implementation of exterior thermal insulation systems, such as ETICS[1]. In the assessment of the durability of these systems, there is a growing demand for hygrothermal comfort studies though very few reports are available regarding their optical properties. Progressively, solutions are being required with darker colours[2], so that the incorporation of nanomaterials might be a possible solution. The optical and catalytic capacity turns nanomaterials into excellent candidates for use in finishing coatings with high solar reflectance with dark colours, without affecting the aesthetic characteristics, thus improving the durability of such coatings [3,4].

Our study targeted the development of innovative envelope systems by increasing their solar reflectance through new finishing coatings formulations with the inclusion of nanoparticles. For that, it is necessary to develop and optimize nanoparticles formulations to achieve a high NIR reflectance. A preliminary study was conducted, demonstrating that the spectral reflectance of a conventional black colorant doped with different nanoparticles with the concentration in the coating being varied (1%, 3%, 5%, 8%, 12%, 16% and 20%), in an acrylic substrates, was increased. Such optical behaviour of the doped black colorant samples was experimentally evaluated through spectral reflectance calculations using a modular spectrophotometer to understand the relation between these properties and the morphological and structural characteristics of the nanoparticles.

The results obtained can help formulating new finishing coatings with increased near-infrared reflectance of buildings façades, using, for instance, more than one type of nanoparticles.

Keywords: Functional nanomaterials, NIR reflective coatings, Energy-efficient buildings.

References:

[1] Barreira et al. (2013), Buil.d Environ. (63), pp.31-39;
[2] Ramos et al. (2021), Infrastructures (6), art. no. 79;
[3] Gonome et al. (2014), J. Quant. Spectrosc. Radiat. (132), pp. 90–98;
[4] Veloso et al. (2021), J. Mater. Sci. (56), pp. 19791–19839

Acknowledgement

This research was financially supported by: Base Funding - UIDB/04708/2020 of the CONSTRUCT - Instituto de I&D em Estruturas e Construções - funded by national funds through the FCT/MCTES (PIDDAC), Project PTDC/ECI-CON/28766/2017 - POCI-01- 0145-FEDER-028766 funded by FEDER funds through COMPETE2020 - Programa Operacional Competitividade e Internacionalização (POCI) and by national funds (PIDDAC) through FCT/MCTES and Project Circular2B - 37_CALL#2 - Circular Construction in Energy-Efficient Modular Buildings financing under the Environment, Climate Change and Low Carbon Economy Programme within the scope of the European Economic Area Financial Mechanism EEA Grants 2014-2021. R.C. Veloso would like to acknowledge the support of FCT – Fundação para Ciência e Tecnologia for the funding of the doctoral grant SFRH/BD/148785/2019.